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A New species of *Agriarctos* (Ailuropodinae, Ursidae, Carnivora) in the locality of Nombrevilla 2 (Zaragoza, Spain)

Una nueva especie de Agriarctos *(Ailuropodinae, Ursidae, Carnivora) en la localidad de Nombrevilla 2 (Zaragoza, España)*

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ABSTRACT

The present study documents a new primitive ursid species, *Agriarctos beatrix* from the Spanish locality of Nombrevilla 2 (Calatayud-Daroca basin, province of Zaragoza). The new fossils of Nombrevilla 2 are closely related to those of *A. depereti* of Soblay (France, Late vallesian), but in the Spanish form the shared derived characters are more primitive. *Agriarctos beatrix* is the oldest occurrence of a member of the subfamily Ailuropodinae in the fossil record.

Keywords: Mammalia, Carnivora, Ailuropodinae, *Agriarctos*, *Nombrevilla 2*, Calatayud-Daroca Basin, Spain, Middle Miocene.

RESUMEN

Una nueva especie de úrsido primitivo, *Agriarctos beatrix* procedente de la localidad de Nombrevilla 2 (Zaragoza, cuenca de Calatayud-Daroca) es descrita en este trabajo. Los nuevos fósiles de Nombrevilla 2 se relacionan estrechamente con *Agriarctos depereti* de la localidad de Soblay (Vallesiense superior, Francia), pero en la forma española los caracteres derivados compartidos son más primitivos. *Agriarctos beatrix* es la primera aparición conocida hasta el presente de un miembro de la subfamilia Ailuropodinae en el registro fossil.

Palabras clave: Mammalia, Carnivora, Ailuropodinae, *Agriarctos*, Nombrevilla 2, Cuenca de Calatayud Daroca, España, Mioceno Medio.

Introduction

The locality of Nombrevilla 2 is placed in the Toril-Nombrevilla section (Calatayud-Daroca Basin). The geological context and paleontological features of this section have already been described in detail by Alvarez Sierra *et al*. (2003). The mammal association located this site in the Upper Aragonian, more precisely in the G3 zone (equivalent to the MN 7/8 unit). The site has been correlated using paleomagnetism with the subchron C5r2n, with an estimated age of 11.6 Ma (Garcés *et al*. 2003). Nombrevilla 2 was a quite peculiar site, consisting of a small bone accumulation, in red detritic sediments included in stratified marls sediments, and exhibiting an extraordinary concentration of micro-mammals. Large mammals were also abundant, but the small size of the accumulation limited the amount of material collected. A preliminary study on the fauna can be found in Álvarez Sierra *et al*. (2003); Lopez *et al*. (2008) have studied the Cricetodontini of this site, indicating the presence of *Hispanomys aguirrei* and *Hispanomys lavocati*. The large mammal associa-

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tion recorded in Nombrevilla 2 is quite different from the known from the lower levels of the same section, as Toril 3, also included in the G3 zone. In particular the major differences in Nombrevilla 2 are the presence of three species of Suidae (*Listriodon splendens*, *Albanohyus steinheimensis* and *Paracleuastochoerus castellensis*) and the first appearance of a member of the Ursidae family in the Iberian central basins, firstly determined as *Ursavus depereti* (Fraile *et al.,* 1997) and later as *Ursavus primaevus* (Álvarez Sierra *et al.,* 2003), being its taxonomic study the main objective of this work.

The presence of three suids in the same locality at the Calatayud-Teruel Basin is a unique fact that won't occur during the Neogene in the Iberian central basins, and brings the faunal association of Nombrevilla 2 close to the ones known for the Upper Aragonian and Lower Vallesian of the Vallés-Penedés Basin. Something similar happens with the record of *Hispanomys lavocati,* also present in the Vallés-Penedés (Lopez *et al.,* 2008). In this context, the presence of an Ailuropodinae in Nombrevilla 2, correlates well with an increase in humidity that is detected in the Calatayud-Daroca Basin, towards the end of Aragonian (Álcala *et al*., 2000, Álvarez Sierra *et al.,* 2003).

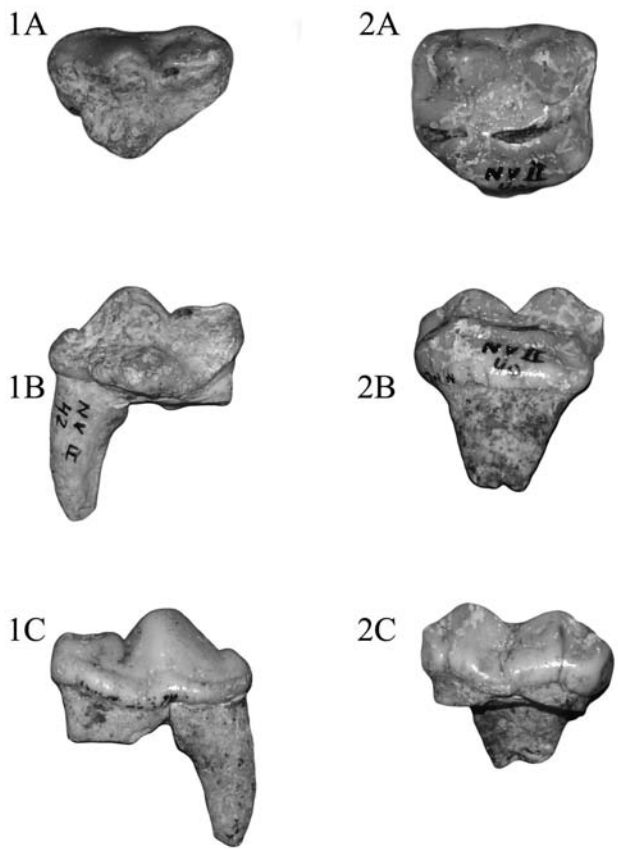

Fig. 1.—*Agriarctos beatrix* nov. sp. from Nombrevilla 2. 1: Holotype. Left P4 (NV-2-42). A: Occlusal view; B: Lingual view; C: Buccal view. 2: Paratype. Right M1 (NV-2-40). A: Occlusal view; B: Lingual view; C: Buccal view.

Systematic palaeontology

Order Carnivora Bowdich, 1821
Suborder Caniformia Kretzoi, 1943: 194
Infraorder Arctoidea Flower, 1869: 15
Parvorder Ursida Tedford, 1976: 372
Superfamiliy Ursoidea Fischer de Waldheim, 1814: 372
Family Ursidae Fischer de Waldheim, 1814: 372
Subfamily Ailuropodinae Grevé, 1894: 217
Genus *Agriarctos* Kretzoi, 1942: 50

Type species: *Agriarctos gaali* Kretzoi, 1942
Type locality: Hatvan, Hungary.
Age: Late Miocene (MN12-13)

Diagnosis: According to Kretzoi (1942), medium sized Ailuropodinae (Agriotheriinen in the original description) - length of the m1 22-28 mm.- with massive dentition. Premolars with weak protoconid and large distal cuspids. m1, short and wide, with strong metaconid, placed forward closing the trigonid completely, typical member (characteristical) of the Ailuropodinae (Agriotheriin in the original description).

Agriarctos beatrix nov. sp.

1997 *Ursavus depereti* Fraile *et al*. p. 78
2003 *Ursavus primaevus* Álvarez Sierra *et al*. p. 31

Derivatio nominis: To Beatriz Azanza for her contribution to the knowledge of the fossil mammals of the Neogene of Aragón region.
Holotype: NV-2-42 Left P4
Paratype: NV-2-40. Right M1.
Type locality: Nombrevilla 2, Calatayud-Daroca basin.
Age: MN 7/8, Upper Aragonian, Middle Miocene.

Diagnosis: *Agriarctos* of small size, smaller than *A. depereti*. P4 with developed protocone, located opposite the paracone. Parastyle well individualized from the paracone but of moderate size. M1 with highly developed metastyle, lingual cingulum poorly differentiated from the protocone and hypocone.

Diferencial diagnosis: *A. beatrix* differs from *A. depereti* from Soblay by the less developed parastyle and the more mesial position of the protocone in the P4. Additionally, the cusps of the labial wall of the P4 (parastyle, paracone and metastyle) are less transversely compressed in *A. depereti*. The

basal labial cingula are less developed in *A. beatrix* than in *A. depereti*. Furthermore, in *A. beatrix* the P4 is slightly longer than the M1, while in *A. depereti* both have more or less the same length. From *A. galli*, type species of the genus, and *A. vighi* it can be distinguished by its smaller size.

Description

NV-2-42 Left P4 (L=18,5 mm, W=13 mm): P4 with subtriangular occlusal shape, with a well-developed protocone located opposite the paracone, almost in a central position. The protocone consists of a rounded cusp and a fairly wide mesial expansion. Parastile of moderate size and well individualized from the paracone. The protocone is low and transversally compressed, its mesial crista is directed slightly outward. The metastyle is thickened, and is well separated by a deep notch from the paracone. The lingual base of the metastyle is very wide, with a marked distal-lingual cingulum. The labial cingulum is well marked.

NV-2-40. Right M1: M1 with quadrangular occlusal shape, slightly longer than wider (L=17.2 mm, W= 15.4 mm). It shows pyramidal paracone, slightly higher than the metacone, both cusps similar in size. Well defined parastyle, but small in size, instead the metastyle is very large. Low protocone, extended distally, located parallel and almost fused to the lingual cingulum. Well-developed conical hypocone, with a smooth inner crista which joins the labial crista of the metacone defining a relatively large sloped valley. The central valley of the trigone is broad and almost circular. The labial cingulum is quite smooth but with an evident thickening of its basal wall. However, it shows a poorly differentiated lingual cingulum.

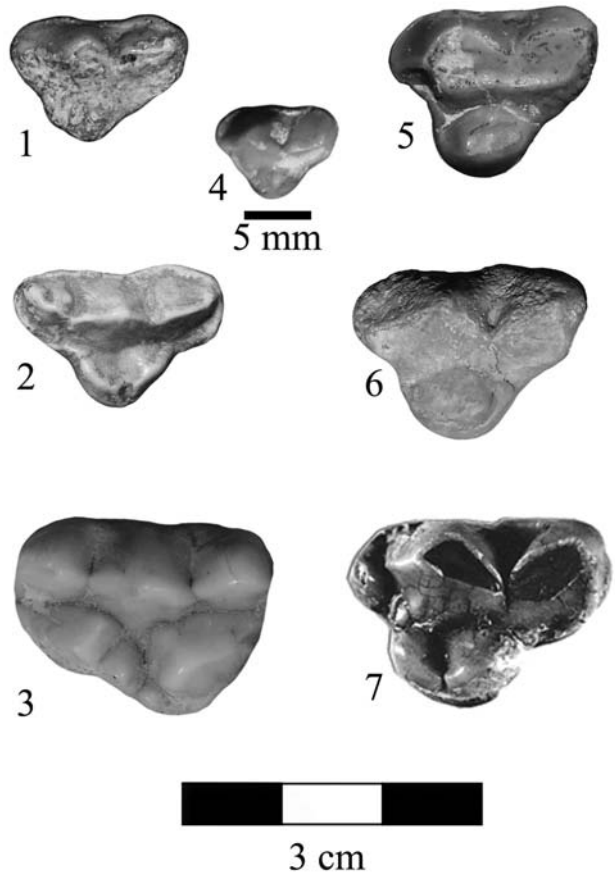

Fig. 2.—Comparison between the P4 of the Ailuropodinae with those of *Ursavus* and *Indarctos* species. 1: *Agriarctos beatrix* nov. sp. (Nombrevilla 2). 2: *Agriarctos depereti* Soblay (Soblay, cast T.F 167 Naturhistorisches Museum Basel). 3: *Ailuropoda melanoleuca* (MNCN-12831). 4: *Ursavus brevirhinus* (Can Llobateres, Crusafont & Kurtén 1976). 5: *Indarctos vireti* (Can Llobateres, Crusafont & Kurtén, 1976). 6: *Indarctos arctoides* (Batallones 3, MNCN-BAT-3'08.357. 7: *Indarctos atticus* (Crevillente 2, Montoya et al., 2001).

Discussion

The genus *Agriarctos* was created by Kretzoi (1942) for a mandible fragment with p3-m2 from the locality of Hatvan (Hungary), with the specific name of *Agriarctos gaali*. Specifically, the genus is characterized by a strong development of the distal cusps of the premolars, usually poorly developed or absent in most of the Ursoidea, and by the forward position of the metaconid of m1. A second species *A.vighi* was proposed by this author for an m1 of the Hungarian locality of Rózsaszentmárton. Two other species, *Ursavus depereti* Schlosser (1902), based on a m1 and m2 from the locality of Melchingen (Germany), and *Ursus ehrenbergi* Brunner (1942), based on an P4-M2 from Halmyropotamus, Euboea (Greece) were also included in *Agriarctos* by Kretzoi (1942). Subsequently, the latter species was reclassified as *Ursavus ehrenbergi* by Thenius (1947). Viret & Mazenot (1947) and Viret (1949) indicated the presence of *Ursavus depereti* in the locality of Soblay, distinguishing this species from other *Ursavus* by the lengthening of the upper carnassial due to the presence of a parastyle. Tobien (1952) also attributed some dental remains (M1 and two m1) from the site of Gau-Weinheim (Germany) to *Ursavus depereti*. Thenius (1979) in his review of the systematics of the Giant Panda validated the genus *Agriarctos* and placed it in the family Ailuropodidae. Regarding the fossils of Soblay determined as *Ursavus depereti* he indicated that could be included in the genus *Agriarctos* only indirectly, since the upper dentition of the material from the type locality is unknown. Similar reasons led Ginsburg & Morales (1998) to determine the species of Soblay as *Agriarctos* cf. *gaali*. Recently, Bernor et al. (2003) have suggested that *Agriarctos galli* could be classified as *Indarctos* cf. *vireti*.

The dentition of Nombrevilla 2 is morphologically close to that determined as *Ursavus depereti* Schlosser, 1902 by Viret & Mazenot (1948) and Viret (1949) at the locality of Soblay, France. In the P4 they share the general elongation of the tooth, the presence of a well-individualized parastyle, the great development of the lingual cingulum and the well developed protocone placed in distal position. In the M1 they share the quadrangular occlusal shape, the strong development of the parastyle and the labial cingulum, the size and extension of the protocone, poorly separated from the lingual cingulum and the development of a sloped valley, separated from the central valley by the joint of the metacone-hipocone cristas. This remarkable similarity between the fossils of Nombrevilla 2 and Soblay indicates a close relationship between these two forms, which however differs in some important characters. For example, in the P4 of the *A.* depereti of Soblay, the cusps of the labial wall (parastyle- paracone-metastyle) are more compressed transversely, being more sectorial; the parastyle is clearly more developed and the protocone is further displaced distally than in the species Nombrevilla 2. Something similar happens in the M1, so that the tooth from Soblay seems more elongated, with a longer hypocone and a broader trigone valley. There are some size differences between the teeth of these two forms, being somewhat smaller in Nombrevilla 2 than in Soblay. However, it is well known that there are significant variations in the dentition size related to the existence of sexual dimorphism in the Ursidae, so this difference is not enough to discriminate these two forms. Nevertheless, the aforementioned morphological differences between these two forms, together with the different proportion between the P4 and M1 (having equal length in Soblay, while in Nombrevilla 2 the P4 is clearly longer than the M1), are of great importance. Therefore, we propose a new specific name: *Agriarctos beatrix* nov. sp.

Even now problems related to the taxonomy and systematics of *Agriarctos* still remain, mostly due to its proximity to *Ursavus* and even to *Indarctos* and to the absence of upper and lower teeth associated in the same locality. As noted above, the development of both distal and mesial accessory cusps on the premolars of *A. galli*, is a major morphological character that marks the beginning of a trend towards the very complex premolars that the giant panda has today. The great development of the metaconid of the m1 as well as its marked mesial position are characters also shared by *Agriarctos galli* and *Ailuropoda melaneuca,* and both with *Ailuractos lufengensis* Qiu & Qi (1989) of Late Miocene of China. Following Thenius (1979) it is very plausible that *Agriarctos galli* and the giant panda are related philogenetically, so the latter should be regarded as a true Ailuropodinae. The correlation between the upper and lower dentitions of *Agriarctos*, asigned to the species *Agriarctos depereti*, seems to have a consistent basis. Therefore, the characters of the upper dentition of Soblay (Viret, 1949), P4 provided with a powerful parastyle, the elongation of the labial cusps (parastyle-metacone-paracone) and the thickening of the basal cingulum of the metastyle are shared derived characters between the giant pandas and *Ailuractos*. By contrast, the M1 of *A. depereti* shows a significant development of the metastyle, apparently absent in *Ailuropoda* and *Ailuractos,* also the elongated morphology of the protocone differences the European from the Asian forms. But undoubtedly, these morphological features of the P4 and M1 from Soblay may be correlated with the morphology of the lower dentition of *Agriarctos*, as Thenius (1979) noted. The new fossils of Nombrevilla 2 are closely related to those of *A. depereti* of Soblay, but in the Spanish form the derived morphological characters are more incipient, sufficiently developed to be easily distinguishable from *Ursavus*.

Conclusion

Agriarctos beatrix is the first occurrence of a member of the subfamily Ailuropodinae in the fossil record. Until this paper, the first Spanish Ursidae were had been recorded in the lower Vallesian of the Vallès-Penedès basin, where two species of *Ursavus* (*U. brevirhinus* and *U. primaevus*) as well as a primitive form of *Indarctos* were described (Crusafont & Kurtén, 1976). This fact is remarkable, considering the general lack of Ursidae (*Ballusia* and *Ursavus*) in the Lower and Middle Miocene faunas of Spain, this absence is a major difference in the carnivores associations of Spain when compared with the European ones. A change to less arid environmental conditions seems to be detected towards the end of upper Aragonian of Calatayud-Teruel basin, these new conditions probably favoured the entry of species like *Agriarctos* or *Albanohyus*. The fossil assemblage of Nombrevilla 2 seems to represent the

typical and short-term environmental conditions in the broader context of the fossil record found in the Calatayud-Teruel basin.

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References

Alcalá, L.; Alonso-Zarza, A.M.; Álvarez-Sierra, M.A.; Azanza, B.; Calvo, J.P.; Cañaveras, J.C.; Dam, J.A. van, Garcés, M.; Krijgsman, W.; Meulen, A. van der, Morales, j.; Peláez-Pampomanes, P.; Pérez González, A.; Sánchez del Moral, S.; Sancho, R. y Sanz Rubio, E. (2000). El registro faunístico y sedimentario de las cuencas de Calatayud-Daroca y Teruel. Evolución paleoambiental y paleoclimática durante el Neógeno. *Revista de la Sociedad geológica de España*, 13: 323-343.

Álvarez Sierra, M.A.; Calvo, J.P.; Morales, J.; Alonso-Zarza, A.; Azanza, B.; García Paredes, I.; Hernández Fernández, M.; van der Meulen, A.J.; Peláez-Campomanes, P.; Quiralte, V.; Salesa, M.J.; Sánchez, I.M. & Soria, D. (2003). El tránsito Aragoniense-Vallesiense en el área de Daroca-Nombrevilla (Zaragoza, España). *Coloquios de Paleontología*, Volumen Extraordinario, 1: 25-33.

Bernor, R.L.; Feibel, C. & Viranta, S. (2003). The vertebrate locality Hatvan Middle Miocene (Middle Turolian, MN 12), Hungary. *In*: *Advances in Vertebrate Paleontology Hen to Panta* (Petculescu A. & Ştiucă, E., eds.), Romanian Academy Emil Racovită Institute of Speleology, Bucharest, 105-112.

Bowdich, T.E. (1821). *An analysis of the natural classifications of Mammalia, for the use of students and travellers*. J. Smith, Paris, 115 pp.

Brunner, J. (1941). Ein Bärenrest aus dem Unterploz¨n von Euboea. *Anzeiger der Akademie der Wissenshaften in Wien. Mathematisch-Naturwissenshaftliche Klasse*, 3: 24-27.

Crusafont, M. & Kurtén, B. (1976). Bears and bear-dogs from the Vallesian of the Vallés-Penedés basin, Spain. *Acta Zoologica Fennica*, 144: 1-29.

Fischer G. (1814). *Zoognosia tabulis synopticis illustrata*, Vol. 3. 3rd ed., Nikolai Sergei Vsevolozsky, Moscow, 732 pp.

Flower, W.H. (1869). On the value of the characters of the base of the cranium in the classification of the order Carnivora, and on the systematic position of *Bassaris* and other disputed forms. *Proceedings of the Zoological Society, London*, 1869: 4–37.

Fraile, S.; Perez, B.; De Miguel, I. & Morales, J. (1997). Revisión de los carnívoros presentes en los yacimientos del Neógeno español. In: *Avances en el conocimiento del Terciario Ibérico* (Calvo, J.P. & Morales, J., Eds.). UCM-CSIC, 77-80.

Garcés, W.; Krijgsman, M.; Peláez-Campomanes, P.; Alvarez Sierra, M.A. & Daams, R. (2003). *Hipparion* dispersal in Europe: magnetostratigraphic constraints from the Daroca area (Spain). *COLPA,* Vol Extra. 171-178.

Ginsburg, L. & Morales, J. (1998). Les Hemicyoninae (Ursidae, Carnivora, Mammalia) et les formes apparentées du Miocène inférieur et moyen d'Europe occidentale. *Annales de Paléontologie*, 84: 71-123.

Grevé, C. (1894). Die Geographische Verbreitúng der jetzt lebenden Raubthiere. *Nova Acta der Ksl. Leop.-Carol. Deutchen Akademie der Naturforscher*, 73: 1-280.

López-Guerrero, P.; Alvarez, M.A.; López-Antoñanzas, R.; Oliver, A. & Peláez-Campomanes, P. (2008). Cricetodontini (Cricetidae, Rodentia) del Aragoniense superior (Mioceno medio) de Nombrevilla 2, (Zaragoza, España). *Palentologica Nova*, 8: 259-271.

Montoya, P.; Alcalá L. & Morales J. (2001). *Indarctos* (Ursidae, Mammalia) from the Spanish Turolian (Upper Miocene). *Scripta Geologica*, 122: 123-151

Qiu Z. & Qi, G. (1989). Ailuropod found from the Late Miocene deposits in Lufeng, Yunnan. *Vertebrata PalAsiatica*. 27: 153–169.

Kretzoi, M. (1942). Zwei neue Agriotheriiden asu dem ungarischen Pannon. *Foldtani Kozlony*. 72: 350-353.

Schlosser, M. (1902). Beitrage zur Kenntniss der Säugerthierreste auf den Süddfutschen Bohnerzen. *Geologische und Palaeontologische Abhandlungen*, 5: 117-258

Tedford, R.H. (1976). Relationships of pinnipeds to other Carnivores (Mammalia). *Systematic Zoology* 25:363–374. doi:10.2307/2412511

Thenius, E. (1947). *Ursavus ehrenbergi* aus dem Pont von Euböa (Griechenland). *Sitzungsberichte der Mathematisch-Naturwissenschaftlichen Classe der Kaiserlichen Akademie der Wissenschaften,* 156: 225-249.

Thenius, E. (1979). Zur systematischem und phylogenetischen Stellungd es bambusbaren: *Ailuropoda melanoleuca* David (Carnivora, Mammalia) *Z. Saugetierk*. 441, 286-305.

Tobien, H. (1955). Neue und wenig bekannte Carnivoren aus den Unterpliozänen Dinotheriensanden Rheinhessens. *Notizbl. hess. L. Amt Bodenforsch*. 83: 7-31.

Viret, J. (1949). Observations complementaires sur quelques mammiferes fossiles de Soblay. *Eclogae Geologicae Helvetiae* 42:469-476.

Viret, J. & Mazenot, G. (1948). Nouveaux restes de mammifères dans le gisement de lignite pontien de Soblay (Ain). *Annales de Paléontologie*, 34: 19-56.

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